

SECTION 15250

INSULATION

PART 1 - GENERAL

1.1 MECHANICAL GENERAL PROVISIONS

- A. The General Provisions of the Contract, including General, Supplementary, and Special Conditions apply to the Work specified in this Section.

1.2 WORK INCLUDED

- A. Duct Insulation
- B. Duct Insulation Accessories
- C. Pipe and Equipment Insulation
- D. Pipe and Equipment Insulation Accessories
- E. Pipe and Equipment Adhesives, Coatings and Sealants

1.3 QUALITY ASSURANCE

- A. Insulation materials, finishes, adhesives, cements, jackets and accessories shall be of the highest grade, shall be the standard products as manufactured by recognized companies, and shall comply with the fire hazard ratings set forth under general and specific requirements specified herein.

1.4 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this Section to the extent referenced. The publications are referenced to in the text by the basic designations only.
 - 1. American Society for Testing and Materials (ASTM) Publications.
 - 2. Underwriters' Laboratories, Inc. (UL) Standards.
 - 3. National Fire Protection Association (NFPA).

1.5 SUBMITTALS

- A. Submit shop drawings and samples in accordance with Section 15000, "MECHANICAL GENERAL PROVISIONS".
- B. Submitted shop drawings shall include complete material data and a list of materials proposed for this project. Indicate thickness of material for individual services. Submittal shall indicate compliance with Fire Hazard Ratings and shall give conductance and density of all materials.

1.6 JOB CONDITIONS

- A. Deliver material to job site in original unbroken factory packaging, labeled with manufacturer's name, density, and thickness.
- B. Perform work at ambient and surface temperature as recommended by the adhesive manufacturer.

1.7 FIRE HAZARD RATINGS

- A. Insulation materials, finishes, coatings, cements, jackets and other insulation accessories shall have composite or individual fire hazard ratings which conform to local, state and federal building codes which control building construction materials that may be used in the particular project location.
- B. Duct coverings, duct linings, panels used in duct systems, and other insulation accessories or piping insulation on pipes within air handling plenums or ducts used for air conditioning and ventilating systems shall comply with NFPA-90A, with fire hazard ratings not greater than the following:
 - 1. Insulations and accessories for the various systems and associated equipment shall be composed of materials which are non-combustible and provide a fire-resistive system of insulation which complies with the applicable code having jurisdiction. Generally, fire hazard ratings shall not exceed the following, except as noted:
 - a. Flame Spread Rating - 25 (No Exceptions)
 - b. Smoke Developed Rating - 50
 - c. Where permitted by applicable codes, standards, etc., a smoke developed rating greater than 50 may be considered, subject to approval by the Architect.
- C. Fire hazard ratings shall be as determined by NFPA-255, "Surface Burning Characteristics of Building Materials" or ASTM E84 or UL 723.
- D. Submittal data covering insulation materials and accessories shall include data sheets which shall positively indicate compliance with the above fire hazard ratings. Where questionable items are submitted, the manufacturer shall submit such additional data as may be requested by the Architect to establish compliance.
- E. Duct coverings and linings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C411-1982 at their rated temperature (not less than 250°F).

1.8 MISCELLANEOUS REQUIREMENTS

- A. Insulation materials herein specified shall be used subject to the manufacturer's temperature limitations and their compatibility with other materials.
- B. Each product container for finishes, adhesives cements, etc., shall bear UL label or shall otherwise indicate compliance with the above fire hazard ratings. Rates of application shall be not less than the rates specified in the manufacturer's published recommendations.

- C. Installation of all insulation work shall be executed by a qualified insulation Contractor who is thoroughly experienced in this particular type of work and who has adequate facilities and equipment for installation of all insulation work herein specified, and who is familiar with the requirements of the local code enforcing authority as to fire hazard ratings.
- D. Types of insulation, thickness, jackets, finishes, etc., shall be as specified in the Insulation Schedules and Charts for the various types of services listed.
 - 1. The finished installation shall present a neat and acceptable appearance with all jackets smooth, with all joints, laps, seals, etc., properly made and with all vapor barriers sealed and intact.
- E. Unless otherwise herein specified or shown on the drawings, the terms "finished spaces" or "exposed areas" as used herein are intended to include all areas except:
 - 1. Furred spaces.
 - 2. Pipe and duct shafts which are not accessible for servicing or maintenance operations.
 - 3. Spaces above furred and suspended ceilings.
 - 4. Unfinished attics.
- F. Unless otherwise specified or shown on the drawings, the word "concealed" is intended to include all areas except "finished spaces" or "exposed areas" as defined above.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass Insulation
 - 1. Certain-Teed Products Corporation
 - 2. Manville Corporation
 - 3. Owens-Corning Fiberglas
 - 4. Knauf
- B. Flexible Elastomeric Insulation
 - 1. Armstrong
 - 2. Halstead
 - 3. Rubatex
- C. PVC Fitting Covers
 - 1. Zeston (Manville)

2. Foster Products Corp.
 3. Proto
- D. Accessories
1. Foster Products Corp. (FPC)
 2. Chicago Mastic (CM)
 3. Childers
 4. 3M
 5. St. Clair Rubber (SCR)
 6. Vimasco (V)
 7. Baldwin-Erber-Hill (BEH)
- E. These specifications, for purpose of brevity and selection, may mention only one manufacturer's product which shall not preclude the use of equal products of other manufacturers as approved by the Architect.

2.2 MATERIALS

A. Duct Insulation

1. Faced flexible glass fiber duct insulation shall have a fire retardant, reinforced foil/kraft vapor barrier facing and shall be equal to Owens-Corning Fiberglass Faced Duct Wrap Series 100. Insulation shall have a nominal thickness of 2 inches and a thermal conductivity of approximately 0.27 at 75 degrees F.
2. Faced rigid glass fiber duct insulation shall have a fire retardant, reinforced foil/kraft vapor barrier facing and shall be equal to Owens-Corning Fiberglass 700 series. Insulation shall have a nominal thickness of 1-1/2 inches, a thermal conductivity of approximately 0.22 at 75 degrees F, and a density of 3 pounds per cubic foot.
3. Coated flexible glass fiber duct liner shall be equal to Owens-Corning Aeroflex PLUS duct liner. Liner shall have a nominal thickness of 1 inch, a thermal conductivity of approximately 0.28 at 75 degrees F, and a density of 1.5 pounds per cubic foot. Coating shall be a black pigmented, fire-resistant coating on the side in contact with the air stream.
4. Ducts, plenums and housings for air handling equipment having internal liners are not to be insulated on the exterior surfaces. Fire dampers shall be externally insulated. Generally, all medium velocity supply air ductwork will be externally insulated unless noted otherwise.
5. Where factory fabricated housings for air handling equipment are specified, they will generally be factory insulated and no exterior insulation will be required. However, where no factory insulation or liners are provided they shall be insulated as shown in the Insulation Schedules and Charts.

B. Duct Equipment Accessories

1. Duct Jackets

- a. Where ASJ jackets are specified or scheduled herein, the use of alternative jackets will be permitted subjected to the following conditions:
- (1) The jackets shall, in finished areas, present a final finished surface which is equal to that of the ASJ jacket as to duty and appearance.
 - (2) The alternative jacket shall perform the same duty as the ASJ jacket, except that hot ductwork will not require the vapor barrier incorporated in the ASJ jacket.
 - (3) In order to avoid the substitution of inferior or inappropriate jackets, all alternative jackets will be subject to review and approval by the Architect.
 - (4) Samples of alternative jackets shall be submitted when requested by the Architect.
- b. Faced flexible and rigid fiberglass duct insulation for cold ducts shall have a factory applied finish jacket equal to Owens-Corning Fiberglass FRK fire retardant, vapor barrier, foil laminated to reinforced Kraft facing.

2. Duct Adhesives, Coating and Sealants

- a. Adhesives, coatings and sealants shall be compatible with other insulation materials as recommended by the manufacturer. The following is a partial list of services and the corresponding material to be used. Other equivalent products as recommended by the manufacturer may be used, subject to approval of the Architect.

<u>SERVICE</u>	<u>MATERIAL</u>
For gluing laps of ASJ jackets	FPC 85 - 20
For securing flexible fiberglass duct insulation to ducts	FPC 85 - 20
For sealing vapor barriers	FPC 30 - 35
For sealing joints in Fiberglas ASJ sealing tape	ASJ Joint

3. Duct Accessories and Fastening Materials

- a. Staples shall be of the outward clinching type of corrosion resisting steel. Use of staples shall be limited to laps of jackets on flexible blanket duct insulation and other materials and locations as approved by the Architect.

C. Pipe and Equipment Insulation

1. Molded glass fiber insulation for pipes in finished and concealed areas shall be equal to Owens-Corning Fiberglass ASJ/SSL-II pipe insulation with all service jacket, with SSLII self sealing system on all cold lines. Insulation shall have a density of approximately 4.0 pounds per cubic foot and a thermal conductivity of not more than 0.23 at 75 deg. F mean temperature, and shall be suitable for surfaces which reach 450 deg. F.
2. Flexible elastomeric insulation for pipes shall be closed cell type and shall be equal to Armstrong AP Armaflex pipe insulation. Insulation shall have a thermal conductivity of not more than 0.27 at 75 degrees F mean temperature.
3. Factory Applied Pipe Insulation
 - a. Hot water piping: Fine glass fiber insulation. "K" value at 75 degrees F maximum 0.25 Btu/in./sq. ft./degree F/hr.
4. Pipe and Equipment Jackets
 - a. Where ASJ jackets are specified or scheduled herein, the use of alternative jackets will be permitted subject to the following conditions.
 - (1) The jackets shall, in finished areas, present a final finished surface which is equal to that of the ASJ jacket as to duty and appearance.
 - (2) The alternative jacket shall perform the same duty as the ASJ jacket, except that hot piping and hot equipment will not require the vapor barrier incorporated in the ASJ jacket.
 - (3) In order to avoid the substitution of inferior or inappropriate jackets, all alternative jackets will be subject to review and approval by the Architect.
 - (4) Samples of alternative jackets shall be submitted when requested by the Architect.
5. Factory Applied Piping Insulation Jackets
 - a. Hot water and steam piping: Standard general purpose jacket.
6. Pipe and Equipment Adhesives, Coatings and Sealants.
 - a. Adhesives, coatings and sealants shall be compatible with other insulation materials as recommended by the manufacturer. The following is a partial list of services and the corresponding material to be used. Other equivalent and equal products as recommended by the manufacturer may be used, subject to approval of the Architect.

<u>SERVICE</u>	<u>MATERIAL</u>
For gluing laps of ASJ jackets	FPC 85 - 20
For sealing vapor barriers	FPC 30 - 35
Fittings, valves, flanges for chilled water piping	FPC 30 - 35 & 30 - 42
For sealing joints in Fiberglass ASJ sealing tape	ASJ joint

7. Pipe and Equipment Accessories & Fastening Materials

- a. Staples shall be of the outward clinching type of corrosion resisting steel. Use of staples shall be limited to laps of jackets on pipe and equipment insulation and other materials and locations as approved by the Architect.
- b. Pre-molded pipe fitting covers shall be one piece PVC sheet material, off white color and shall be equal to Zeston 2000. Use shall be subject to the manufacturer's limitations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Duct Insulation

1. Surfaces to be insulated shall be clean, dry and free from rust and scale when insulation is being applied. Insulation shall be dry at the time of installation and before and during the process of finish application.
2. Insulation shall not be applied before ducts have been proved tight at the specified test pressures.
3. Round flexible connections to air distribution devices shall be externally insulated with flexible, vapor barrier type insulation. Where fire dampers are installed in externally insulated ducts, they shall be externally insulated same as specified for externally insulated ducts. Coordinate Insulation Work with that of ductwork to ensure external insulation overlaps internal liner at least 2 inches.
4. Surfaces of insulation shall be smooth, even and true to line with jackets drawn tight and smoothly secured. Scrap pieces of insulation shall not be used where a full length section will fit.
5. The tops of all diffusers shall be insulated in the same manner as connecting ductwork to prevent condensation.
6. Insulation shall be continuous through non-rated walls, partitions and floors unless otherwise noted.
7. Only experienced mechanics, skilled and trained in the insulation trade, shall be used for application of the insulation materials.

B. Factory Applied Pipe Insulation and Jacket

1. Obtain instruction from the manufacturer in the application of field applied joint insulation. Manufacturer to certify in writing that contractor has received such instruction.

3.2 INSTALLATION

A. Duct Insulation

1. Faced Flexible Glass Fiber

- a. Insulation shall be tightly wrapped on the ductwork with all circumferential joints butted and longitudinal joints lapped 2 inches and stapled. Joints shall be sealed with approved adhesive. Adhere insulation to ducts with 4 inch wide strips of an approved bonding adhesive, at 12 inches on center. For ducts 24 inches or greater in width, secure insulation to bottom of ductwork with mechanical fasteners spaced at not greater than 18 inches on center.
- b. Insulation shall be butted with facing overlapping all joints at least 2 inches and sealed with approved fire retardant vapor barrier adhesive. Breaks, punctures, pin penetrations in facing shall be sealed with vapor barrier tape and vapor barrier adhesive. Joints shall be taped with vapor barrier tape and vapor barrier adhesive where so recommended by the manufacturer's published installation instructions.

2. Faced Rigid Glass Fiber

- a. Insulation shall be cut and applied using mechanical fasteners. Fasteners shall be located not less than 3 inches from each edge or corner of the board. Pin spacing along the duct shall be no greater than 12 inches on center. Circumferential joints and longitudinal joints shall be sealed with a pressure sensitive joint sealing tape to match the insulation facing.
- b. Insulation shall be butted with facing overlapping all joints at least 2 inches and sealed with approved fire retardant vapor barrier adhesive. Breaks, punctures, pin penetrations in facing shall be sealed with vapor barrier tape and vapor barrier adhesive. Joints shall be taped with vapor barrier tape and vapor barrier adhesive where so recommended by the manufacturer's published installation instructions.
- c. Exterior insulation shall be covered with two coats of weatherproof coating as recommended by the insulation manufacturer over the entire insulation surface. Embed a layer of glass cloth in between coats.

B. Pipe and Equipment Insulation

1. General

- a. Installation of all Insulation Work shall be executed by a qualified insulation contractor who is thoroughly experienced in this particular type of work and who has adequate facilities and equipment for installation of

all insulation work herein specified, and who is familiar with the requirements of the code enforcing authority as to fire hazard ratings.

- b. Types of insulation, thickness, jackets, finishes, etc., shall be as specified in the Insulation Schedule and Charts for the various types of services listed.
- c. The finished installation shall present a neat and acceptable appearance with all jackets smooth, and with all vapor barriers sealed and intact.
- d. Surfaces to be insulated shall be clean, dry and free from rust and scale when insulation is being applied. Insulation shall be dry at the time of installation and before and during the process of finish application.
- e. Insulation shall not be applied before pipe lines have been proved tight at the specified test pressures.
- f. Valves, flanges and fittings, except threaded unions in hot water piping, shall be insulated to the same thickness as the pipe insulation.
- g. The insulation at threaded unions in hot water piping shall be tapered and terminated with cement and glass lagging cloth and lagging adhesives. Insulation shall be continuous through non-rated walls, partitions and floors unless otherwise noted. Refer to the heading FIRESTOPPING AND SMOKESTOPPING.
- h. Insulate exterior surfaces of all anchors and guides for chilled water piping system.
- i. A complete moisture and vapor barrier shall be installed wherever insulation terminates against pipe saddles, hangers or other projections through insulation and in contact with cold surfaces for which a vapor seal is specified. Pipe saddles shall be filled with insulation, and shall be vapor sealed on cold piping.
- j. Nameplates, ASME and other inspection stamps on hot equipment shall not be covered. Metal covers shall be furnished and installed at manhole and thermostat openings, nameplates and stamps with insulation neatly finished thereto.

2. Molded Glass Fiber Pipe Insulation

- a. Insulation of this type used with copper tubing shall be molded to separate dimensional standards than those of steel pipe.
- b. In finished areas, molded glass fiber insulation or fiberglass pipe wrap shall be used to insulate piping where commercially available sizes can be used.
- c. Fittings on pipe lines in finished and concealed areas shall be covered with flexible fiberglass insulation inserts and premolded pipe fitting covers equal to Zeston 2000 fitting covers where sizes are available. Insulation shall fill the fitting cover and shall not leave any void spaces. The use of premolded pipe fitting covers shall be subject to the limitations set forth

by the manufacturer. For sizes where premolded fitting covers are not available use miter-cut segments of molded pipe insulation, wired in place, with all joints sealed with adhesive and smoothed out with a coat of insulating cement. Flanges, strainers, automatic and manual valves shall be insulated with mitered segments of pipe insulation wired in place with joints and raw edges sealed with adhesive and smoothed out with a coat of insulating cement.

- d. On cold pipes, the fittings shall be finished with two coats of an approved vapor barrier mastic, reinforced with glass cloth extending 2 inches onto adjacent pipe insulation. Where premolded pipe fitting covers (Zeston 2000) are used, the vapor barrier shall lap over and onto the adjacent pipe insulation. Hot pipes shall be finished in a similar manner, except the mastic need not be of the vapor barrier type.

3. Factory Applied Pipe Insulation

- a. Apply joint insulation per manufacturer's instructions.
- b. Inspect insulation before installation to ensure material integrity.

4. Factory Applied Pipe Insulation Jackets

- a. Apply joint jacket per manufacturer's instructions.
- b. Inspect insulation jacket before installation to ensure material integrity.

3.3 FIELD QUALITY CONTROL

Visually inspect to ensure that materials provided conform to specifications. Inspect installations progressively for compliance with requirements.

A. Air Distribution Systems

Obtain written approval of systems under Section 15030, "ADJUSTING, BALANCING AND SYSTEM TESTING" before applying field insulation to air distribution systems.

B. Piping Systems

Obtain Contracting Officer's written approval of HVAC water distribution systems under Section 15030, "ADJUSTING, BALANCING AND SYSTEM TESTING" before applying field-applied insulation to HVAC water distribution systems. At Contractor's option and with Contracting Officer's written approval, piping systems may be insulated before systems are tested, adjusted, and balanced (TAB'd). Piping insulation shall terminate immediately adjacent to each flow control valve, automatic control valve, or device. For chilled water and chilled-hot water piping systems, seal ends of pipe insulation and space between ends of pipe insulation and piping with waterproof vapor barrier seating. After systems are TAB'd, insulate control valves and devices.

3.4 SCHEDULE

A. Duct Insulation

Service	Type Insul	Finishes		Notes
		Concealed Areas	Finished Areas	
Concealed Interior Low Pressure A.C.	Flexible Glass Fiber	FRK Vapor Barrier	FRK Vapor Barrier	
Supply Outside & Mixed Air & Fire Dampers	Flexible Glass Fiber	FRK Vapor Barrier	FRK Vapor Barrier	
Exterior Ductwork	Rigid Glass Fiber	FRK Vapor Barrier	FRK Vapor Barrier	
** Low Pressure Supply & Return Outside & Mixed Air In Exposed Locations	Rigid Glass Fiber	FRK Vapor Barrier	FRK Vapor Barrier	
Return	* Flexible Glass Fiber	FRK Vapor Barrier	FRK Vapor Barrier	
Transfer Ducts as Indicated	Duct Liner			
High Pressure Supply Duct	Consult duct fabrication requirements for lined ductwork, otherwise as noted or like supply ductwork			

* Unless otherwise noted on drawings or specifications.

** Also applies to all exterior insulated ducts conveying conditioned air thru heated only spaces including exhaust, return and relief air systems.

B. Pipe Insulation

Chilled Water	Rigid Glass Fiber A/1	ASJ/SSL-II	ASJ/SSL-II
Heating Hot Water	Rigid Glass Fiber A/2	ASJ/SSL-II	ASJ/SSL-II
Domestic H.W. & H.W. Return	Rigid Glass Fiber A/3	ASJ/SSL-II	ASJ/SSL-II
Domestic C.W.	Rigid Glass Fiber A/6	ASJ/SSL-II	ASJ/SSL-II
Roof Drain Sumps (including overflow) & Horizontal Rain Leaders (including overflow)	Rigid Glass Fiber A/7 & 8	ASJ/SSL-II	ASJ/SSL-II
Interior A.C. Condensate Drain & Water Cooler Drain	Rigid Glass Fiber A/9	ASJ/SSL-II	ASJ/SSL-II
*Floor Drains Plus 20' of drain pipe from F.D.	Rigid Glass Fiber A/10	ASJ/SSL-II	ASJ/SSL-II
**Refrigerant Suction	Rigid Glass Fiber A/11	ASJ/SSL-II	ASJ/SSL-II

*Note: Applies to floor drains above first floor receiving cold condensate.

**Note: Refrigerant suction piping does not require insulation specified herein if preinsulated piping is used.

Note: Flexible elastomeric pipe insulation may be used in lieu of rigid glass fiber on A.C. condensate and refrigerant suction.

NOTE: Provide corrugated or smooth aluminum jacket for all insulated pipes 0'-0" to 6'-0" above finished floors and mezzanines for insulation protection.

CHART A
PIPE INSULATION THICKNESS BASED ON RIGID GLASS FIBER

Refer Line No.	Piping System	System Temp. Range Deg. F	Insulation thickness in inches for Pipe Sizes (R=4.0 - 4.6)				
			1” & Less	1-1/4” -2”	2-1/2” -4”	5-6”	8” or larger
	Cooling Systems						
1**	Chilled Water	42-55	1-1/2	1-1/2	1-1/2	2	2
	Domestic, Hot Water And Steam Systems						
2	Heating Hot Water	140-200	1-1/2	1-1/2	1-1/2	2	2
3	Domestic Hot Water & H.W. Return	110-140	1	1	1-1/2	1-1/2	1-1/2
4	Domestic Cold Water	48-80	1/2	3/4	1	1	1
5	Interior A.C. Condensate Drain & Water Cooler Drain	All	1/2	3/4	--	--	--
6 *	Floor Drains	All	--	1/2	1/2	--	--
7	Refrigerant Suction	All	1/2	1/2	--	--	--

* NOTE: Applies to floor drains above the first floor receiving cold condensate.

** NOTE: Exterior chilled water piping insulation thickness shall be 1/2 inch greater than insulation thickness listed.

END OF INSULATION